(Following Paper ID and Roll No. to be filled in your Answer Book)

PAPER ID : 7113 Roll No. | | | | | | | | | | |

M.B.A.

(SEM. II) THEORY EXAMINATION 2010-11

OPERATIONS RESEARCH

Time : 3 Hours *Total Marks : 100*

SECTION—A

(Attempt **all** questions) **(1×10=10)**

1. Fill in the blanks :

   (a) Linear programming deals with the _____. Of a function of variables known as objective function.

   (b) The expression $a_1x_1+a_2x_2+a_3x_3+\ldots\ldots\ldots+a_nx_n$ is _____.

   (c) Simplex method was developed by _____ .

   (d) A set of variables is called a solution of L.P.P. if it satisfies the _____.

   (e) Surplus variables are always accompanies with _____.

   State TRUE/FALSE :

   (f) Pure strategy is the decision rule to always select a particular course of action.

(g) Utilization factor is the average time for which a customer has to wait in the queue to get service.

(h) One of the objective of the network analysis is to minimize the idle resources and investment in inventory.

(i) Static models are one time decision models.

(j) Vogel's approximation method is also known as regret method.

2. **(1×10=10)**

(i) One requirement in optimality test of transportation problem is that the number of allocations should equal to :

(a) (m n) (b) (m + n + 1)

(c) (m + n – 1) (d) None of above

(ii) It is a basic feasible solution in which all the m basic variables are positive (≥ 0) and the remaining n variables are zero each :

(a) Degenerate basic feasible solution

(b) Non-degenerate basic feasible solution

(c) Solution

(d) Basic solution

(iii) If the primal contains n variables and m constraints the dual will contain.

(a) n variable (b) m variable

(c) n + 1 variable (d) m + 1 variable

(iv) The constants c_1, c_2, c_3 ....., c_n in the objective function of the primal appear in the _____ of the dual.

(a) Objective function

(b) Non negativity restrictions

(c) Constraints

(d) All of above

(v) According to this rule jobs are sequenced in the order of non decreasing due dates :

(a) EDD (b) STR

(c) SPT (d) FCFS

(vi) The maximum time taken by an activity for completion is known as :

(a) Expected time (b) Optimistic time

(c) Pessimistic time (d) None of these

(vii) All the activities which are on the critical path are called :

(a) Critical activities (b) Slack

(c) Float (d) None of the above

(viii) In decision tree analysis decision node is represented by :

(a) Circle (b) Triangle

(c) Straight line (d) None of the above

(ix) Latest start time can be calculated by using :

(a) Backward pass (b) Forward pass

(c) Both (a) and (b) (d) None of the above

(x) The dual of the dual is called :

(a) Simplex (b) Primal

(c) Second dual (d) None of the above

SECTION—B (1×30=30)

3. (i) The following table shows all the necessary information on the available supply from each warehouse, the requirement of each market and the unit transportation cost in rupees from each warehouse to each market.

		Markets				
		I	II	III	IV	Supply
	A	6	3	5	4	22
	B	5	9	2	7	15
Ware house	C	5	7	8	6	8
Requirement		7	12	17	9	45

The shipping clerk has worked out the following schedule from experience : 12 units from A to II, 1 unit from A to III, 9 units from A to IV, 15 units from B to III, 7 units from C to I and 1 unit from C to III.

Find :

(a) check if the clerk has made the optimal schedule. 5

(b) Find the optimal schedule and minimum and minimum total shipping cost. 5

(c) If the supply from warehouse B reduces to 12 units and simultaneously the requirement of market III reduces to 14 units, find the optimal transportation schedule. 5

(ii) An airline that operates 7 days a week has the time table shown below. Crew must have minimum layover of 5 hours between flights. Obtain the pairing of flights that minimizes layover time away from home assuming that the crew can

be based at either of the two cities. The crew will be based at the city that results in smaller layover.

	Delhi-Jaipur			Jaipur-Delhi	
Flight no.	Depart	Arrive	Flight no.	Depart	Arrive
1	7 AM	8 AM	101	8 AM	9.15 AM
2	8 AM	9 AM	102	8.30 AM	9.45 AM
3	1.30 AM	2.30 AM	103	12 NOON	1.15 PM
4.	6.30 PM	7.30 PM	104	5.30 PM	6.45 PM

15

OR

3. (a) Customers arrive at the first class ticket counter of a theater at the rate of 12 per hour. There is one clerk serving the customers at the rate of 30 per hour.

(i) What is the probability that there is no customer in the counter ? 5

(ii) What is the probability that there are more than two customers in the counter ? 4

(iii) What is the probability that there is no customer waiting to be served ? 4

(iv) What is the probability that a customer is being served and nobody is waiting ? 3

(b) The purchase price of a machine is Rs.52,000. The installation charges amount to Rs. 14,400 and it's scrap value is only Rs. 6,400. The maintenance cost in various years is given below :

Year	: 1	2	3	4	5	6	7	8
Maintenance cost :	1,000	3,000	4,000	6,000	8,400	11,600	16,000	19,200

After how many year should the machine be replaced ? Assume that the machine replacement can be done only at the year ends. 14

SECTION—C

4. Attempt any **two** questions : **12.5**

(a) Convert the following problem into its dual :

Minimum $z = 2x_1 + 2x_2 + 4x_3$,

Subject to, $2x_1 + 3x_2 + 5x_3 \geq 2$

$3x_1 + x_2 + 7x_3 \leq 3$

$x_1 + 4x_2 + 6x_3 \leq 5$

And $x_1, x_2, x_3 \geq 0$

(b) An investor is given the following investment alternatives and percentage rates of return.

	Low	Medium	High
Regular shares	7%	10%	15%
Risky shares	–10%	12%	25%
Property	–12%	18%	30%

Over the past 300 days, 150 days have been medium market conditions and 60 days have had high market increases.

On the basis of these data, sate the optimum investment strategy for the investment.

(c) Give Johnson's procedure for determining an optimal sequence for processing in items on two machines. Give justification of the rule used in procedure.

5. Attempt any **two** questions: **12.5**

(a) Give a brief account of the methods used in model formulations.

(b) Solve the following LPP graphical method.

Maximum $z = x_1 + x_2$

Subject to, $x_1 - x_2 \geq 0$

$-3x_1 + x_2 \geq 3$

And $x_1, x_2, \geq 0$.

(c) Solve the following game :

		Player B			
		I	II	III	IV
	I	2	2	3	–1
Player A	II	4	3	2	6

6. Attempt any **two** questions: **12.5**

(a) A project has the following times schedule :

Activity	Time in weeks
1-2	4
1-3	1
2-4	1
3-4	1
3-5	6
4-9	5
5-6	4
5-7	
6-8	1
7-8	2
8-9	1
8-10	8
9-10	7

Construct PERT network and compute :

(i) T_E and T_L for each event

(ii) Float for each activity

(iii) Critical path and its duration

(b) Solve the following LPP :

$$\text{Minimum } z = x_1 - 3x_2 + 2X_3,$$

$$\text{Subject to, } 3x_1 - X_2 + 3X_3 \leq 7$$

$$-2x_1 + 4x_2 \leq 12$$

$$-4X_1 + 3X_2 + 8X_3 \leq 10$$

$$\text{And } x_1, x_2, x_3 \geq 0$$

(c) Describe the fundamental components of a queuing process and give suitable examples.

7. Attempt any two questions : **12.5**

(a) Find the optimal solution of the following transportation problem in which cell entries represent unit costs.

		To			
		W1	W2	W3	Available
From	F1	4	14	8	10
	F2	6	6	2	16
	F3	10	8	14	14
	F4	2	12	4	28
Required		14	18	36	68

(b) Explain the Hungarian method to solve an assignment problem.

(c) Explain the concepts of degeneracy in simplex method.